

## REMARKS

This application has been carefully reviewed in light of the Office Action dated January 11, 2005.

The drawings were objected to because the drawings include reference characters not mentioned in the description of the present patent application.

Claims 2 to 38 were objected to because of informalities.

Claims 10, 11 and 37 were objected to because of informalities.

Claim 35 was objected to for being an improper Markush group.

Claims 1 to 8, 12 to 14, 20 to 29, 32 and 34 to 35 were rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmerman et al. (US 6144536) and further in view of Zou et al. (US 6186649).

Claims 9 to 11, 15 to 19, 30 to 31, 33 and 36 to 38 were objected to as being dependent upon a rejected base claim but otherwise allowable if rewritten in independent form including all the limitations of the base and intervening claims.

The drawings were objected to because the drawings include reference characters not mentioned in the description of the present patent application.

Amendments to the Drawings will be filed under separate cover.

Claims 2 to 38 were objected to because of informalities.

The claims have been amended to correct these informalities without adding any new matter.

Claims 10, 11 and 37 were objected to because of informalities.

The claims have been amended to correct these informalities without adding any new matter.

Claim 35 was objected to for being an improper Markush group.

The claim has been amended to a proper Markush group.

Claims 1 to 8, 12 to 14, 20 to 29, 32 and 34 to 35 were rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmerman et al. (US 6144536) and further in view of Zou et al. (US 6186649).

The Zimmerman et al. patent discloses an illumination system with a light source; a light reflecting and recycling means; a light transmitting means of a tapered waveguide; and a light

extracting means which includes a light collimator, to enhance the output luminance of the illumination system.

The Zou et al. patent discloses an illumination system with a linear light source and an external reflective enclosure.

The present patent application in independent claim 1 claims an illumination system with a light-emitting diode (LED) light source with an emitting layer and a reflecting layer; a light recycling envelope; and an output aperture in the light-recycling envelope, where the area of the output aperture is less than the area of the emitting layer of the LED light source to maximize the exiting radiance of the illumination system.

There are several patentable distinctions between the Zimmerman/Zou combination reference and the claimed invention of the present patent application.

The present patent application claims that the area of the output aperture of the light-recycling envelope is less than the area of the emitting layer of the LED light source.

In both the Zimmerman et al. patent and in the Zou et al. patent, the critical area relationship between the area of the output aperture and the area of the source is not disclosed. The Office Action acknowledges that the area relationship does not exist in Zimmerman et al. but attempts to infer an area relationship in Zou et al.

In Zou et al., a relationship between the area of the output aperture and the area of the source is not disclosed. Zou et al. does disclose a relationship between the width of the output aperture (linear opening) and the maximum inside width of the external enclosure. In addition, for one and only one type of light source, a tubular fluorescent lamp, Zou et al. does disclose a relationship between the width of the output aperture and the width of the tubular fluorescent lamp.

One cannot use the width relationship in Zou et al. to infer an area relationship for two reasons. First, a width measurement can be used to determine an area only if additional information is provided. Knowing the width of the output aperture and the width of the source, an area relationship can only be determined if the relationship between the length of the output aperture and the length of the source is known. The relationship between the length of the output aperture and the length of the source is not disclosed in Zou et al.

Second, it is clearly stated in Zou et al. (column 5, lines 25 to 34 and column 7, lines 8 to 17) that the relationship between the width of the output aperture and the width of the light source covers only the case of tubular fluorescent lamps. There is no disclosed width relationship if the light source is one or more light emitting diodes.

A typical light source utilizing LEDs is likely to be constructed from an array of multiple LEDs as shown in Figure 10 et seq of the present patent application. The array of LEDs may be arranged inside the cavity in a wide variety of ways. For example, the LEDs may be arranged as one row of separated LEDs, two rows of separated LEDs, one row of LEDs that are in side-to-side contact or two rows of LEDs where the LEDs in each row are in side-to-side contact but the two rows are separated. It is clear that for a light source that is an array of LEDs, the width (or length) of the output aperture cannot be compared to the width (or length) of the array without providing additional information about how the LEDs are arranged in the array.

The relationships stated above that come from the text of Zou et al. are also reiterated in claims 1-4 of Zou et al. Again it is clear that the relationship between the width of the output aperture and the width of the source only refers to tubular fluorescent lamps, not the claimed light emitting diode of the present patent application.

The present patent application claims that the area of the output aperture of the light-recycling envelope is less than the area of the emitting layer of the LED light source, which is not disclosed in the Zimmerman et al. patent and the Zou et al. patent. The Zou et al. patent discloses a width relationship but only for a tubular fluorescent lamp. The present patent application is for an LED light source.

The illumination system of the Zimmerman et al. patent has four separate elements; (1) the light source, (2) the light reflecting and recycling means, (3) the tapered waveguide, and (4) the light extracting means with the light collimator.

The illumination system of the present patent application has two separate elements; (1) a different light source from the Zimmerman et al. patent and (2) a different light reflecting and recycling means from the Zimmerman et al. patent.

The illumination system of Zimmerman et al. patent has more and different optical elements than the claimed illumination system of the present patent application.

The result of the illumination system of the Zimmerman et al. patent is to enhance the output luminance of the illumination system.

The result of the illumination system of the present patent application is to maximize the exiting radiance of the illumination system.

Luminance and radiance are not the same optical concept and are not the same optical result for an illumination system.

Radiance is a unit of brightness. Light flux or radiant flux is expressed in watts. Radiance is defined as watts per square meter per steradian (where steradian is the unit of solid angle). Radiance is measured across the entire light spectrum.

Luminance is also a unit of brightness but one that takes the human eye response into account. The human eye, however, is more sensitive to some wavelengths of light (for example, green light) than it is to other wavelengths (for example, blue or red light). Luminance is brightness as observed by the human eye. Luminance is defined as lumens per square meter per steradian. The human eye is only sensitive to light in the wavelength range from approximately 400 nanometers to approximately 700 nanometers. Light having wavelengths less than about 400 nanometers or greater than about 700 nanometers has zero luminance, irrespective of the radiance values.

Accordingly, luminance has a narrower wavelength range than radiance and is a subset of radiance.

The desired result (enhanced luminance) of the illumination system of the Zimmerman et al. patent is different from the desired result (maximized radiance) of the present patent application.

With regard to the independent claim 1 of the present patent application, the claimed invention of the present patent application has several patentable distinctions over the Zimmerman et al patent in view of the Zou et al. patent. The claimed invention of the present patent application has an illumination system with a different light source (LED versus fluorescent lamp), with an area of the output aperture of the light-recycling envelope less than the area of the emitting layer of the LED light source (a requirement not disclosed in the prior art), which achieves a different illumination result (maximizing radiance rather than enhancing luminance).

With regard to dependent claim 2, the Office Action states that the Zimmerman et al patent discloses that the maximum exiting radiance is greater than the maximum intrinsic source radiance as detailed in the Abstract.

Actually, the Abstract of the Zimmerman et al. patent says that the output luminance is greater than the intrinsic luminance of the bare light source. As detailed with regard to claim 1, luminance and radiance are not the same thing.

The limitation of claim 2 with a maximum exiting radiance is greater than the maximum intrinsic source radiance is not found in the Zimmerman et al. patent reference.

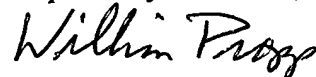
With regard to dependent claims 3 to 8, 12 to 14, 20 to 29, and 34 to 35, all these claims are dependent directly or indirectly on independent claim 1. Claims 3 to 8, 12 to 14, 20 to 29, and 34 to 35 will be patentable based on the patentability of its independent claim 1.

Claims 9 to 11, 15 to 19, 30 to 31, 33 and 36 to 38 were objected to as being dependent upon a rejected base claim but otherwise allowable if rewritten in independent form including all the limitations of the base and intervening claims.

The claims have been amended without adding any new matter.

If the Examiner deems that a telephone conference would expedite the prosecution of the present application, the Examiner is invited to call the undersigned attorney at (310) 820-9869.

Respectfully submitted,



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